Claims

What is claimed is:

1. A Digital Subscriber Line system comprising a transmitter for reusing bit allocations and gain factors for a normal data transmission mode mode in a low power mode, the transmitter comprising:

a first memory for storing the bit allocations and gain factors for the normal data transmission mode and a bit allocation threshold value, T;

a constellation mapper communicatively coupled to the memory, a data buffer and a pseudo random sequence generator, the mapper determining a number of bits to be retrieved for an ith sub-carrier, b_i', in a low power mode based on a number of bits allocated, b_i, for the ith sub-carrier in the normal transmission mode and the bit allocation threshold T;

a transmitter control unit communicatively coupled to the constellation mapper and the memory, the control unit processing messages from a receiver, including messages related to mode operation; and

a constellation encoder communicatively coupled to receive the determined number of bits for the ith sub-carrier from the mapper.

2. The system of claim 1 further comprising a receiver for reusing bit allocations and gain factors for the normal data transmission mode in a low power mode, the receiver comprising:

a second memory for storing the bit allocations and the gain factors for the normal data transmission mode and the bit allocation threshold value, T;

a constellation demapper communicatively coupled to the memory and communicatively coupled to receive a signal in an ith sub-carrier from the transmitter, the demapper determining the number of bits, b_i', allocated by the transmitter for this ith sub-carrier, in the low power mode

based on the number of bits allocated, b_i, for the ith sub-carrier in the normal transmission mode and the bit allocation threshold T;

a receiver control unit communicatively coupled to the constellation demapper and the memory, the control unit processing messages related to mode operation from the transmitter; and

a constellation decoder communicatively coupled to receive an indicator of the determined number of bits allocated for the ith sub-carrier from the demapper.

3. The system of claim 1 wherein the constellation mapper, responsive to the number of bits allocated for the ith sub-carrier, b_i, in the normal transmission mode being less than a bit allocation per sub-carrier threshold T, retrieving a default number of bits for the ith-sub-carrier in the low power mode from the pseudo random sequence generator, and responsive to a gain scale factor, g_i, for the corresponding ith sub-carrier in the normal data transmission mode being non-zero, the transmitter transmitting a dummy signal in the ith-subcarrier.

4. The system of claim 1 wherein the constellation mapper, responsive to the number of bits allocated for the ith sub-carrier, b_i, in the normal transmission mode being greater than or equal to a bit allocation per sub-carrier threshold T, selects the number of bits to be retrieved, b_i', for the ith-sub-carrier in the low power mode in accordance with $b_i' = b_i - T +$ a constant.

5. The system of claim 1 wherein the constellation mapper, responsive to the number of bits allocated for the ith sub-carrier, b_i, in the normal transmission mode being greater than or equal to a bit allocation per sub-carrier threshold T, selects two bits as the number of bits to be retrieved, b_i', for the ith-sub-carrier in the low power mode.

6. The system of claim 4 wherein, responsive to the number of bits allocated for the ith sub-carrier, b_i, in the normal transmission mode being greater than or equal to a bit allocation per

sub-carrier threshold T, the constellation encoder encoding the number of bits b_i' for the ith sub-carrier into a signal using the gain scale factor g_i for the corresponding ith sub-carrier used in normal mode.

7. The system of claim 1 wherein the transmitter transmits a combined signal of the sub-carriers for the low power mode at about or below a power reduction level.

8. The system of claim 1 wherein the power reduction level is below or equal to a maximum allowable power cutback level.

9. The system of claim 7 wherein the power reduction level is less than or equal to a power reduction level based on the size of the bit allocation threshold T wherein the power reduction level satisfies a signal-to-noise (SNR) margin which is about equal to the SNR margin for the normal transmission mode plus a power factor scaled by the difference between the SNR margin required to support a bit constellation having the bit threshold T size and a constant constellation bit size.

10. The system of claim 9 wherein the combined signal is transmitted at about or below a power reduction level which is the lesser of a maximum allowable power cutback level or the power reduction level based on the size of the bit allocation threshold T.

11. In a Digital Subscriber Line system, a method for determining the number of bits to be retrieved for an ith sub-carrier, b_i', in a low power mode based upon a bit allocation b_i for the ith sub-carrier in a normal transmission mode, the method comprising:

responsive to the number of bits allocated for the ith sub-carrier, b_i, in the normal transmission mode being less than a bit allocation per sub-carrier threshold T, selecting a default number of bits to be retrieved for the ith-sub-carrier in the low power mode; and

responsive to the number of bits to be retrieved, b_i', for the ith-subcarrier in the low power mode being the default value and the normal data transmission mode gain scale factor, g_i, for the ith sub-carrier being non-zero, transmitting a dummy signal in the ith-subcarrier.

12. The method of claim 11 further comprising:

responsive to the number of bits allocated for the ith sub-carrier, b_i, in the normal transmission mode being greater than or equal to a bit allocation per sub-carrier threshold T,

selecting the number of bits to be retrieved, b_i', for the ith-sub-carrier in the low power mode in accordance with $b_i' = b_i - T +$ a constant.

13. The method of claim 11 further comprising:

responsive to the number of bits allocated for the ith sub-carrier, b_i, in the normal transmission mode being greater than a bit allocation per sub-carrier threshold T, selecting two bits as the number of bits to be retrieved, b_i', for the ith-sub-carrier in the low power mode.

14. The method of claim 12 further comprising:

responsive to the number of bits allocated for the ith sub-carrier, b_i, in the normal transmission mode being greater than or equal to a bit allocation per sub-carrier threshold T,

encoding the number of bits b_i' for the ith sub-carrier into a signal in the low power mode using the gain scale factor g_i for the corresponding ith sub-carrier used in normal mode.

15. The method of claim 12 further comprising:

responsive to receiving a signal in the ith-sub-carrier, determining the number of bits, b_i', that have been allocated at a transmitter for the ith sub-carrier in the low power mode based upon the bit allocation b_i for the ith sub-carrier for the normal data transmission mode.

16. The method of claim 15 further comprising:

responsive to the number of bits allocated for the ith sub-carrier, b_i, in the normal transmission mode being less than the bit allocation per sub-carrier threshold T, identifying that the ith sub-carrier is carrying a dummy signal.

17. The method of claim 16 further comprising:

responsive to the number of bits allocated for the corresponding ith sub-carrier, b_i, in the normal transmission mode being greater than or equal to a bit allocation per sub-carrier threshold T, determining the number of bits, b_i', for the ith-sub-carrier in the low power mode in accordance with $b_i' = b_i - T +$ a constant; and

decoding the symbol for the ith sub-carrier based on b_i'.

18. The method of claim 15 further comprising:

responsive to the number of bits allocated for the corresponding ith sub-carrier, b_i, in the normal transmission mode being greater than or equal to a bit allocation per sub-carrier threshold T, identifying two bits as the number of bits b_i', for the ith-sub-carrier in the low power mode; and

decoding the symbol for the ith sub-carrier based on b_i'.

19. A Digital Subscriber Line system comprising a transmitter for reusing bit allocations and gain factors for a normal data transmission mode mode in a low power mode, the transmitter comprising:

means for storing the bit allocations and gain factors for the normal data transmission mode and a bit allocation size threshold value, T;

means for determining a number of bits to be retrieved for an ith sub-carrier, b_i', in a low power mode based on a number of bits allocated, b_i, for the ith sub-carrier in the normal

transmission mode and the bit allocation size threshold T being communicatively coupled to the means for storing, a data buffer and a pseudo random sequence generator;

means for processing messages from a receiver, including messages related to mode operation, communicatively coupled to the means for determining a number of bits to be retrieved and the means for storing; and

means for constellation encoding communicatively coupled to receive the determined number of bits for the ith sub-carrier from the means for determining a number of bits to be retrieved in a low power mode.

20. The system of claim 19 further comprising a receiver for reusing the bit allocations for the normal data transmission mode in the low power mode, the receiver comprising:

a second means for storing the bit allocations for the normal data transmission mode and the bit allocation threshold value, T;

means for determining the number of bits, b_i', allocated by the transmitter for this ith sub-carrier, in the low power mode based on the number of bits allocated, b_i, for the ith sub-carrier in the normal transmission mode and the bit allocation threshold T, being communicatively coupled to the second means for storing and communicatively coupled to receive a signal in the ith sub-carrier from the transmitter;

means for processing messages related to mode operation from the transmitter communicatively coupled to the means for determining the number of bits, b_i', allocated by the transmitter and the second means for storage; and

means for constellation decoding communicatively coupled to receive an indicator of the the determined number of bits allocated for the ith sub-carrier from the means for determining the number of bits, b_i', allocated by the transmitter.